To: Economic Impact Committee

Jeff Thorsteinson, Chief Security Officer, Involta – Nov. 19, 2015

My view: North Dakota could serve as a National/World Disaster Recovery Center with a cluster of RPAs, imagery analysts and data center resources so as to be able to task assets with prioritized missions in preparation, response and recovery phases. The cost of operating the RPA, staffing the disaster center and reducing the overall cost of disasters would be balanced against FEMA's overall 2014 budget ($9.59B requested) and further appropriations for actual disasters (disasters not included in the $9.59B). The key would be to reduce the cost of operating the RPAs, consolidation of data tracking resources, eliminating fraud, improving response and mitigation of impact.

SUMMARY DATA

Chemical/Biological – There have been relatively few (9) since 1962, and they have been quite diverse. RPAs would be extremely useful to tracking the extent of the spread. Given that this is also a threat from terror, the use of RPAs should be practiced and readied as a homeland security response. But there is little cost reduction from the nine examples. I would suggest it is a national defense readiness issue, as an RPA could make use of air sampling, high definition pictures and various multi-spectral and hyper-spectral sensors to determine the extent of impact. Last declared disaster was January, 2014, in West Virginia and individual and public expenditures are not yet available.

Coastal Storm – A very predictable disaster wherein the use of RPAs before and after the event can contribute to fast insurance settlements, identification and prioritization of issues and security for relocation centers. RPAs can also determine the extent of the storms intrusion into waterways, underlying infrastructure damage, coastline impacts, impurities released within the watershed, traffic flows and augment police/security in abandoned areas. In 2007, Tropical Storm Erin accounted for about $4.4M in FEMA relief and a coastal storm in Rhode Island and Massachusetts accounted for about $7.5M in FEMA relief. Private insurance costs would be beyond these numbers.

Dam/Levee Break – Not very many occur, but high hazard/high consequence list is very large. Prior RPA actions would facilitate intense inspection, including water levels, propagating faults and margin to safety for rainfall. After failure actions are much the same as flooding and coastal storm. Avoidance is the big savings, as the amount of damage is significant. **See EXAMPLE – Wolf Creek Dam below.**

Drought – Actually shares time with Precision Agriculture from a practical standpoint, but the main impact of RPAs might be routine assessment of the upstream sources. Enforcement of a watering ban can also be easily supported by RPA. This is a main focal point of agriculture. 2012, a pretty good year for farming, still had $17B in loss coverage (not just from drought). This is the Risk Management Agency (established in 1996) working for the Federal Crop Insurance Corporation, which uses private insurers to insure about 85% of farmland (282 million acres insured).

Earthquake – Ideal opportunity to use RPA in conjunction with USGS Seismicity. RPAs can provide before and after images for insurance, as well as follow waypoints for infrastructure assessment after an event. RPAs could quickly identify routes for safe evacuation and could verify status of secondary impact events. For those earthquakes that are tied to areas that routinely exhibit activity (such as Yellowstone), the RPAs can be used to provide record checks. The cost of the 2011 Fukushima earthquake is estimated at $235B. The cost of the 1995 Kobe earthquake is estimated at $100B. The cost of the 1994 Northridge earthquake is estimated at $42B. The cost of the 2008 Sichuan China

earthquake is estimated at $29B dollars. That's 4 of the top 5 disasters monetarily (Katrina is the other top five entry at $81B. The loss of life is difficult to assess, which would move the 2004 Indian Ocean earthquake/tsunami up from $14B (and many others). RPAs could at least compliment the diagnostics available to earthquake experts. Especially those RPAs with specialized sensor capacities (ultra low frequency radio wave sensors, as ULF may correlate as a predecessor indicator for earthquakes – subject to scientific debate and research).

Explosions – These are pretty random. The recent fertilizer plant in Texas is over $4M in FEMA relief. I don't see a repetitive role for RPA, but a mission could certainly be tasked to provide images and sample atmosphere.

Extreme Temperatures – This area requires more study, as many of the actual disasters are counter-intuitive (cold weather in warm places, warm weather in cold places, both to an extreme). Some of it aligns with agriculture (picture Florida oranges). Very predictable, so perhaps RPA tasking could be developed, at least to support the insurable angles.

Fire/Wildfire – Lots of declared disasters or fire management authorizations, lots of property endangerment. Often begins remotely. RPA monitoring could provide early alerting during high risk days/nights, or follow lightning storms. An RPA with a suppressant payload could be configured, after detection, to provide timely response. This is an area that should be categorized by season, ignition source, fire hazard status, spread of the fire, dollars expended and private insurer impact. Other parameters may be matrices as well. These events are very big strains on non-Federal organizations. I think a patrol pattern could be established based on risk factors, with containment response advanced by coordination between agencies/jurisdictions from a National Disaster Center.
Flooding – Most are predictable, most are enduring, many can be lessened. Cumulative, may be highest cost area. Coordination amongst Army Corps of Engineers, NOAA and monitoring of the watershed could be role of National Disaster Center. RPAs could provide pre-flood documentation for recovery purposes. **SEE MISSOURI RIVER example below.**

Hurricane – Even more predictable than floods. RPAs can be used for before/after, for monitoring of abandoned areas after storm passes. Should be of use to private insurance as claims impact their financial results in a dramatic fashion.

Industry Hardship – The salmon industry and shrimp industry are examples. Local RPAs could be used for counts, but I don't see this as a big input into national disasters.

Mudslides/Landslides – Current circumstances in Washington State are heartbreaking. I don't know of any unique role that RPAs could play, unless information gained from RPAs could help with stability of remaining soil (obviously search and rescue).

Radiation Leak – Air sampling, radiation monitoring, global response. Likely to have contamination issues to consider. Very infrequent event.

Severe Storms – A great number of declarations of various severities. National Disaster Center response likely based on severity and nature of insurable event (such as agriculture)

Straight-Line Winds – Of great use to agriculture, as path of straight-line wind can be immediate input into crop insurance.

Terrorism – Not many events, some very impactful. I think this is oriented towards National Defense. The National Disaster Center could contribute to response to terrorism, but I don't see a lead role. Tasking from Homeland Security or the Military.

Tsunami – Associated with earthquakes, RPAs would be useful in assessing before and after if able to be on-station ahead of the landing of the tsunami.

Tornado – Before/after for insurance recovery, security…often involves flooding as well. Region of the country is predictable, weather conditions contributing to tornadoes are known, and immediate assessment of damage after the event to marshal resources beyond local capabilities would be valuable.

Volcano – RPAs are ideal for pre-eruption, eruption and post-eruption coverage. World wide service. Main impact is life safety, but could progress to techniques to better direct flows. Also can be input to airline routes.

Winter Storms – A major contributor to declarations. RPAs can add value in providing prioritization of restoration of transportation routes and electrical system restoration.

EXAMPLE – Wolf Creek Dam (*there are 84,000 dams in the US with an average age of 52 years, there are 13,991 high hazard dams, with 2,000 high hazard dams rated as "deficient". High hazard designation deals with the impact on population below the dam, which generally increases over time – ten years ago there were 3,873 fewer high hazard dams. There are also 12,662 significant hazard dams, which involve impact on property moreso than people. In 2020, 70% of America's dams will be over 50 years old. http://www.infrastructurereportcard.org/a/#p/dams/overview)*

Located in Kentucky, the dam was placed into service in 1951. It is built into a Karst limestone foundation (Karst is a specific formation involving voids). The dam is earthen for its longest section for the impoundment, with the concrete portion of the dam spanning the Cumberland River. In 1968 the base of the dam was found to have significant leakage. Repair efforts involved pumping concrete into the voids and, in 2013, consisted of placing a retaining wall on the impoundment side of the dam. The level of the impoundment has been 40 feet below normal for much of the past decade, so as to reduce the pressure of the standing head of water on the leaky base of the dam. In 2014, the water will be raised 20 feet and monitored. Beyond that, restoration to normal level (another 20').

If the Wolf Creek dam fails, such as a breach of the earthen portion of the dam, it is projected to result in 20' to 30' of water in downtown Nashville, TN. Nashville, TN is approximately 250 miles downstream from the Wolf Creek Dam. Overall property damage is estimated, by the US Army Core of Engineers, at $3B to $3.5B.

RPAs should be used to status America's dams (at least high hazard) on a regular basis and when warranted given challenging conditions (nearby earthquakes or record rains, for example).

EXAMPLE – Missouri River Flooding in 2011 (US Interstates I-29 and I-680 were closed (I-29 for 3 months) and required $40M in repairs.)

A Rocky Mountain snowpack of 212% of normal, coincident melting and 600% of normal rains in the last two weeks of June contributed to prolonged Missouri River flooding and subsequent impact from waterlogged levees.
Six dams on the Missouri river where required to release beyond prior record release levels.

Dam	Previous record flow	Previous record year	Flow May 1, 2011[7]	Flow May 31, 2011[7]	Flow June/July 2011
Fort Peck Dam	35,000	1975	7,000	9,700	65,500 (June 19)[8]
Garrison Dam	65,000	1975	17,400	80,400	150,200[9]
Oahe Dam	59,000	1997	29,400	86,300	160,300[9]
Big Bend Dam	74,000	1997	21,200	83,900	165,000 (planned)[10]
Fort Randall Dam	67,000	1997	42,300	76,600	157,000 (planned)[10]
Gavins Point Dam	70,000	1997	45,000	77,000	160,700[11]

Note that release flows on May 1st, 2011, were a fraction of flows in June/July. Releases are typically dictated by established Army Corps of Engineers policies/practices that balance flood control, some power generation and upcoming recreational use. In this particular year, May releases also had to consider the flooding on the Mississippi River.

RPAs could've been used to track the snowpack and the Missouri River system, including tributaries and dams, as well as the Missouri's confluence with the Mississippi. The RPA information could've been used to adjust release flows in March and April so as to balance flooding along the Mississippi and the Upper Region of the Missouri. The task is difficult, as the Mississippi floods in 2011 in May required operation of emergency spillways near Memphis and the deliberate flooding of unoccupied land.

An examination of inflows and outflows in March indicate most of the reservoirs adding 2' to 3' in reservoir level.

My aim is not to criticize the Army Corps of Engineers, but to get a collection of resources (rainfall across various basins is a known, reservoir levels are a known, snowpacks can be a known) so that the National Disaster Center could offer insight and information to the Army Corps.

Jeff Thorsteinson | Chief Security Officer
P.O. Box 1986 Cedar Rapids, IA 52406
C: 319-551-5168|
O:319-261-3009|E:jthorsteinson@involta.com

Take a virtual tour inside the vault: www.involta.com/

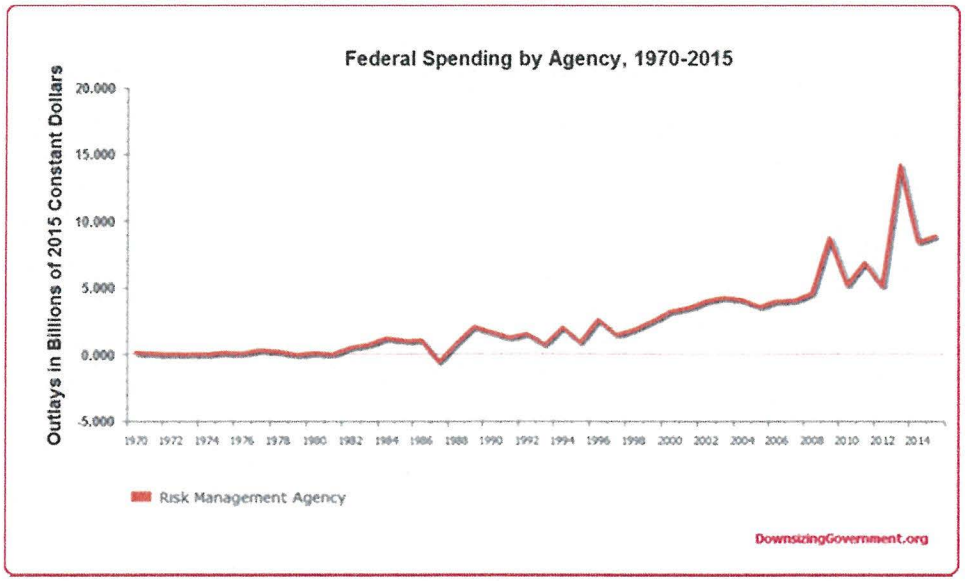
Jeff Thorsteinson testimony for Nov 19th, relative to the Risk Management Agency

Economic Impact Committee – The Honorable Senator Connie Triplett

I have gathered information associated with data and first responders as requested. I have organized references so as to demonstrate economic impact. I hope that the good and Honorable Legislators of the State of North Dakota are well served.

RISK MANAGEMENT AGENCY

94% of cotton, 84% of corn, 84% of wheat and 34 other crops are subject to RMA coverage from 19 private companies. The actual execution of Federal Crop Insurance Corporation damage inspections is to have a crop inspector draw up a diagram of the amount of crop damaged. Often, the inspector is a neighbor of the farmer involved. If 10% accuracy could be gained, and payments made speedily, economic benefits accrue for the payee and the payer; the farmer and the government. 10% of $16B is $1.6B. At $23,000 per hour of operation for the Global Hawk, almost 70,000 hours are available, allowing for automated processing, determination of type of damage, potential replants and the resulting data can potentially turn the spending trend.



The linked analysis indicates the relevant and applicable trends of performance associated with crop insurance.
http://www.cropinsuranceinamerica.org/about-crop-insurance/facts-figures/#.Vkc2Bzm9xhM
Here are GAO recommendations for Crop Insurance. http://www.gao.gov/assets/670/665267.pdf

I respectfully suggest that the impact of crop insurance costs and methods can be bettered through the use of a distributed common ground station to interact with private companies providing services to the RMA for the Federal Crop Insurance Corporation. The UAS can do many other things when flying to, from and over the desired path, including following storms that cause flooded seeds, wind damage or other damage such as hail. Grand Sky would be the place to consider as UAS are already tasked and data missions could be combined.

The ECONOMIC IMPACT is in turning the spending trend for crop insurance saves the US Taxpayer, the farmer, allows for greater harvest from timely replant reimbursements and provides long term performance data for analysis. I hope the Great State of North Dakota seizes the opportunity.

Note that drought tracking can also be done with the overflights, contributing to water management.

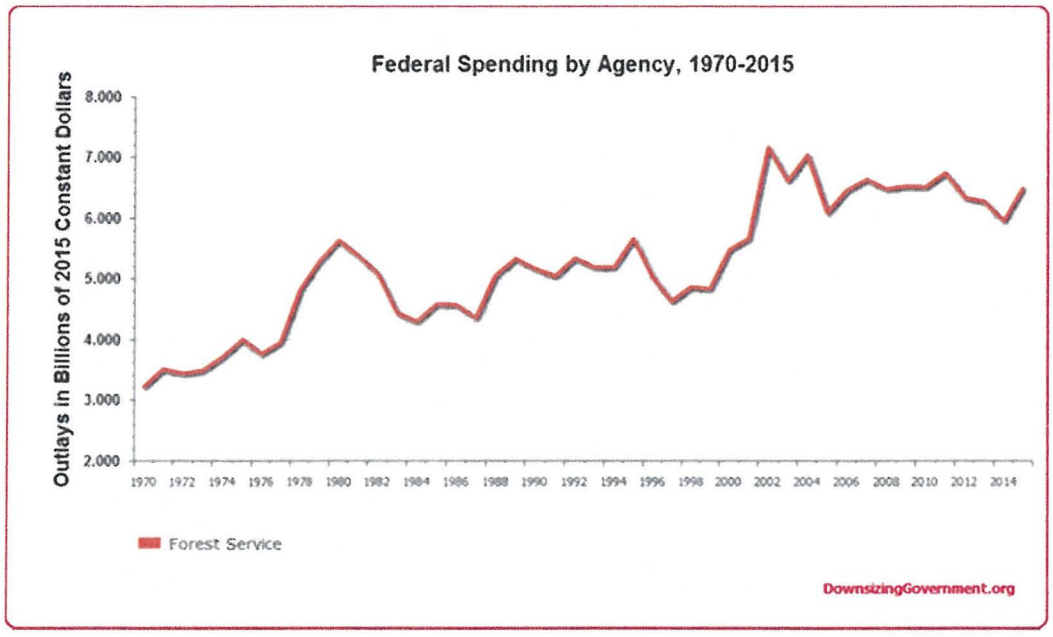
Jeff Thorsteinson |Chief Security Officer
P.O. Box 1986 Cedar Rapids, IA 52406
C: 319-551-5168|
O:319-261-3009|E:jthorsteinson@involta.com

Take a virtual tour inside the vault: www.involta.com/

SUPERIOR INFRASTRUCTURE + OPERATIONAL EXCELLENCE + PEOPLE WHO DELIVER

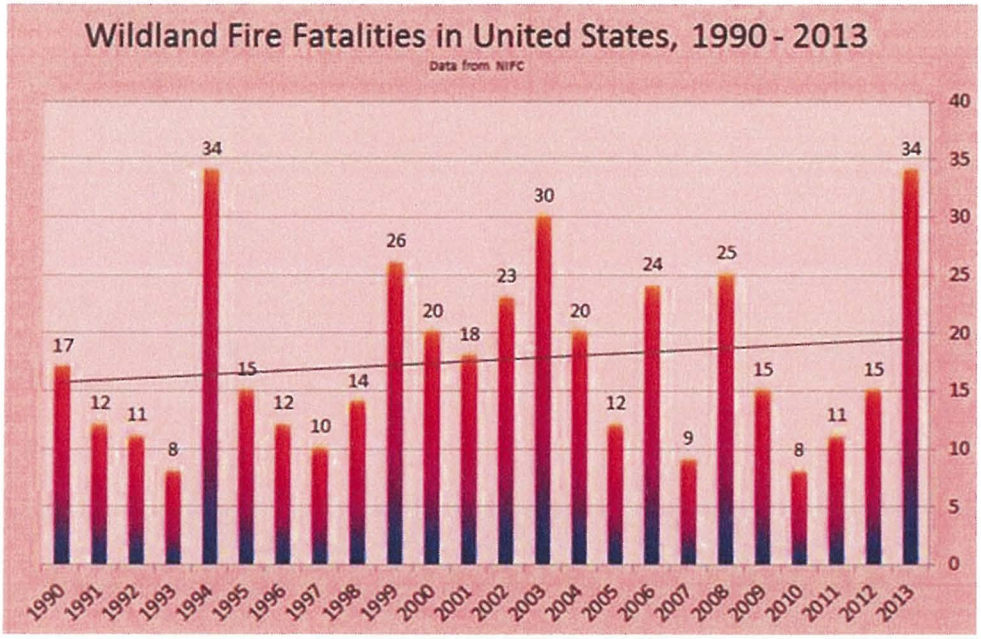
The Forest Service – Jeff Thorsteinson, Involta, Nov. 19, 2015

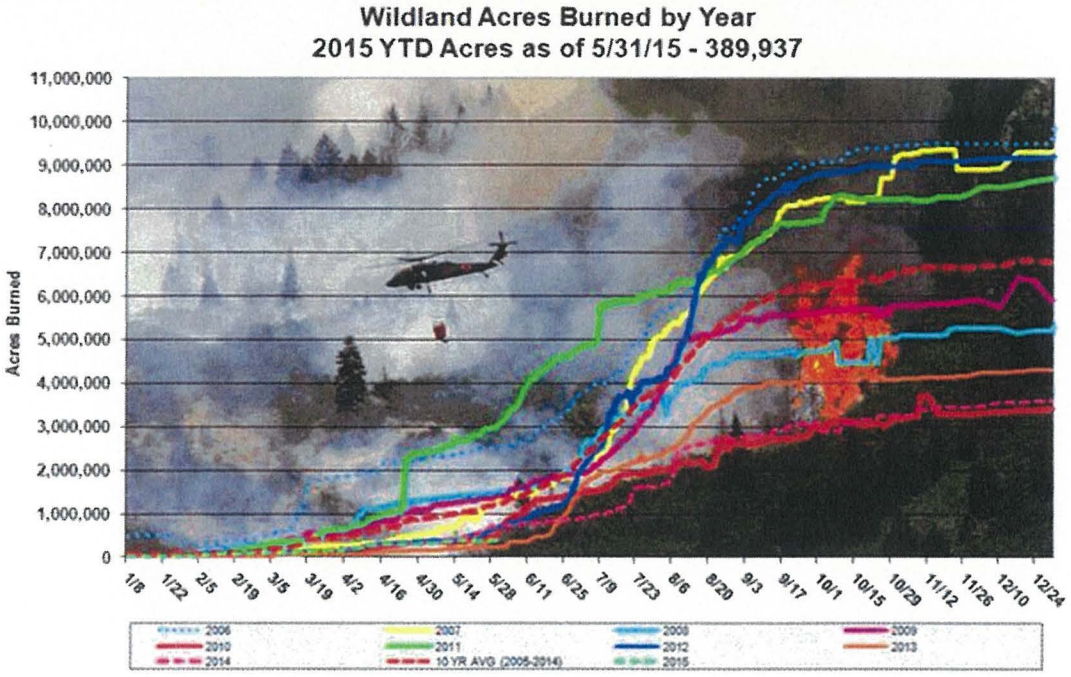
Four of five fires are started by humans and most of the remainder by lightning. The impact of forest fires is increasing. http://www.srs.fs.usda.gov/compass/2013/09/17/how-forest-fires-start-modeling-wildfire-ignitions/



The linked analysis indicates that The Forest Service is consuming more resources for fighting forest fires, leaving other missions unserved. http://www.fs.fed.us/sites/default/files/2015-Fire-Budget-Report.pdf

I respectfully suggest that the impact of forest fires can be reduced through the use of a distributed common ground station to interact with the National Fire Incident Command center in Boise, Idaho, such that UAS flights can be tasked during times of higher fire risk (relative humidity, dry conditions, available fuel, lightning and human activity) to spot ignitions early. A dispersant filled UAS can be tasked to the right spot to quench the fire before involving risk to fire fighters, property and other populations. The UAS can do many other things when flying to, from and over the desired path. Some are indicated below. Grand Sky is already connected to the NFIC in Boise and can task existing assets. The ECONOMIC IMPACT is in turning the spending trend by reducing the impact of major fires. In 2015, through July, $1.65B had been spent by in fighting fires. At $23,000 per hour of flight operation for Global Hawk or equivalent, 36,000 hours, or 1,495 days of flight operations could be supported. 24 hour monitoring operations could be supported for just over $200M. This does NOT include reduction of economic impact associated with loss of life by first responders, other populations or loss of property. The trends below must be reverse to reduce the economic impact of fires.





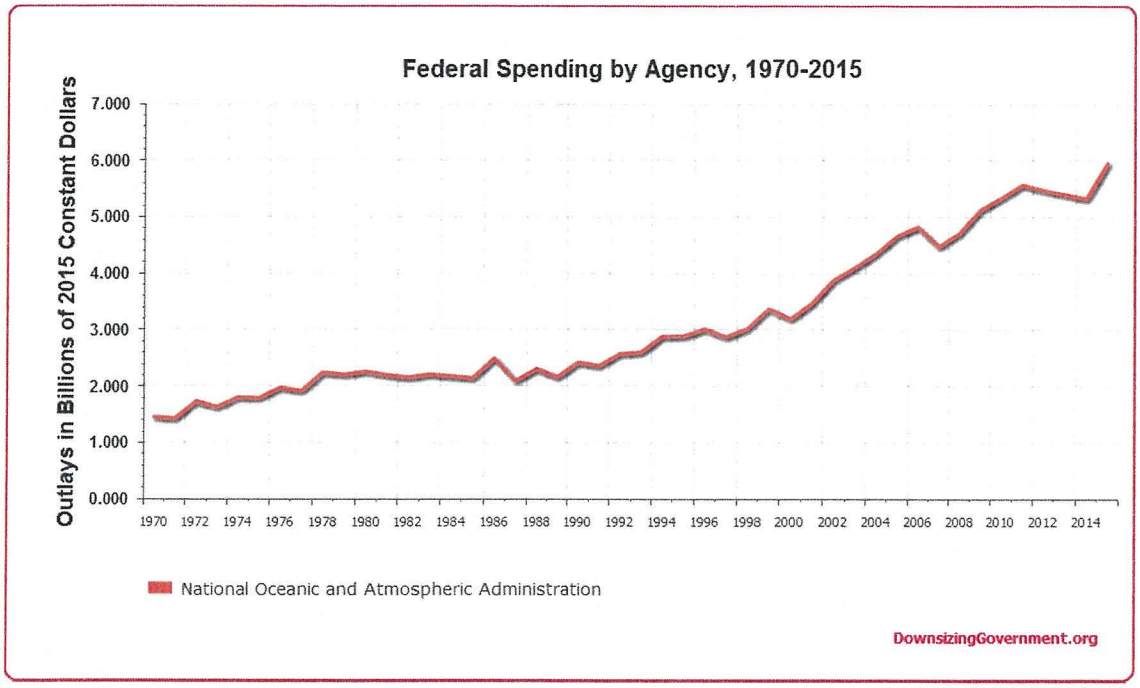
Jeff Thorsteinson |Chief Security Officer
P.O. Box 1986 Cedar Rapids, IA 52406
C: 319-551-5168|
O:319-261-3009|E:jthorsteinson@involta.com

Take a virtual tour inside the vault: www.involta.com/

SUPERIOR INFRASTRUCTURE + OPERATIONAL EXCELLENCE + PEOPLE WHO DELIVER

National Oceanic and Atmospheric Agency – Jeff Thorsteinson, Involta – Nov. 19, 2015

The agency tracks weather, including hurricanes, as well as other atmospheric events. http://www.nhc.noaa.gov/
Hurricanes are destructive events, involving loss of life and damage to property. A flight prior to and after the hurricane would provide detailed images of assets affected by weather.



I respectfully suggest that the impact of NOAA's work can be bettered through the use of a distributed common ground station. The UAS can do many other things when flying to, from and over the desired path. Grand Sky would be the place to consider as UAS are already tasked and data missions could be combined.

The ECONOMIC IMPACT is in turning the spending trend NOAA saves the US Taxpayer, those affected by severe weather and through prevention of loss of life and timely action on insurable losses.

Note that tracking can also be done on tornadic activity and water shed flooding with the overflights, contributing to water management for the Corps of Engineers. Flooding in the MidWest kept I-29 out of service for an extended time during 2011.

Jeff Thorsteinson | Chief Security Officer
P.O. Box 1986 Cedar Rapids, IA 52406
C: 319-551-5168|
O:319-261-3009 | E:jthorsteinson@involta.com

Take a virtual tour inside the vault: www.involta.com/

SUPERIOR INFRASTRUCTURE + OPERATIONAL EXCELLENCE + PEOPLE WHO DELIVER